BLD10 Service Manual

INTECNO s.r.l.
via Caduti di Sabbiuno n. 9/E
40011 Anzola Emilia (BO)Italy
tel. 051.19985350 fax 051.19985360

Agency approvals

CE COMPLIANCE:

89/336/EEC Electromagnetic

EN 55011 Compatibility

EN 550082-1

98/37/EC Safety of Machinery

EN 60204-1

The EC mark that is applied to the drives references to the Low Voltage Directive (2006/95/EC) and EC Directive on EMC (89/336/EC).

The standard EN 61800-5-1 is applied to ensure conformance with the Low Voltage Directive.
The standard EN 61800-3 is applied to ensure conformance with the EMC Directive.

In reference to noise immunity and noise emission the converters fulfi l the requirement to the category second environment (industrial environment).
If the installation of the drive is carried out differently than described in this manual, the user must carry out new measures to satisfy the requisites of law.

CONDITIONS OF ACCEPTABILITY
The devices shall be installed in compliance with the enclosure, moun ting, spacing, and segregation requirements of the ultimate application.

These devices are intended as open type equipment. The need to repeat a temperature test shal be considered in final end use application

These devices are suitable for field wiring

WARNING - Risk of damage and/or personal injury

This drive doesn't contain any user serviceable part. Attempting to replace any internal component, may result in damage to the unit and/or personal injury. This may also avoid the warranty.

All the informations and concepts included in this user guide are copyright, and are supplied to the user with the understanding that it may not be copied, disclosed or duplicated in whole or in part for any purpose not authorised by the factory. All specifications are subject to change without prior notification.

Print in Italy 02/2015

Index

Chapter 1

1.1	Safety and note	4
1.2	Operation mode and feedback	5
1.3	Characteristics	6
1.4	Product view	7
1.5	Ambient conditions	8
1.6	Ventilation	9
1.7	Power supply construction	10
1.8	Notes about connection	12
1.9	Connections to earth and ground	13
1.10	Dimensions	14
1.11	Pin ount overview	15
1.12	Internal adjustments	17

Chapter 2

2.1	Brushless motor with Hall signals	19
2.2	Set up data for Intecno's motors	21
2.3	Ramp time adjustments	22
2.4	Intecno motors' connections	23
2.5	HW direction selection	24
2.6	Basic command diagram	24
2.7	Analog speed input	26
2.8	REQ torque input	27
2.9	Start input	28
2.10	Current monitor output	28

Chapter 3

3.1	Speed offset adjustments	29
3.2	Trimmers adjustments	30
3.3	Dynamic adjustments	31
3.4	Brushless motor with encoder + hall sensors	32
3.5	Set up for encoder feedback	33

Chapter 4

4.1	Indicator LEDs and protections	35
4.2	Troubleshooting	36

APPENDIX

A	Resistance values decoding by the means of color's rings	37

1.1 Safety and note

Caution

Users must take care that this motion control equipment is capable of producing high forces and rapid movement so they must be used with attention especially during the application program's development.

This motion control equipments are sold as end-users products to be installed only by practical staff in accordance with all local safety laws and regulations. The device have to be enclosed such that any part is not be accessible while the system is powered on.

We strongly reccomend to follow these recommendations in order to avoid wrong uses of the equipment that may be impaired all the protections provided by the device.

Please read these notes carefully before powering up the drive

It is very important to meet all applicable safety requirements during installation and operating of any motion control equipment. Any installer has to assume the responsibility to ensure that he recognizes and complies all the relevant safety standards. Any installation, not meeting the safety requirements, may damage the equipment or injury the user.

This motion control equipment shoul be handled, installed, setted-up and maintenanced only by competent personnel expert and trained in the installation of motion control electronic equipment. Such technicians should be aware of potential electrical and mechanical hazards. Shall never beliable or have any responsability if the products have been improperly stored, installed, used or maintened, or if the costumer has permitted any unauthorized modifications, adjustments, and/or repairs to the products.

Simbols security standard

Warning of dangerous current present
In case of doubt or in any case you don't know as to behave yourself, before access to the drive, power off the device and wait until all the LEDs are turned off.
May you have attention when you touch the drive because it may be hot.

Danger Sign
All the circuits in the Drive are potential sources of severe electrical shock, so follow these rules to avoiding possible personal injury.
- Power off the drive and wait until all the leds are turned off before touching, removing, connecting or any other critical action.
- Never disconnect any connectors before powering down the drive

1.2 Operation mode and feedback

Description

This is a drive capable of piloting DC brushless motors.
It's a High Performance full four quadrant drive. The mosfet output power stage is controlled by a 20 Khz PWM (Pulse Width Modulation) signal that allows it to drive servo motors where high dynamic performance and precise speed is required.

Operation mode

DESCRIPTION		
SPEED CONTROL INPUT	It is speed piloting using an analogue reference (differential or common mode)	STANDARD
TORQUE CONTROL INPUT	It is torque piloting using an analogue reference. This function allows you to control the current from the drive.	STANDARD

General characteristic

DESCRIPTION		
START INPUT	Start input, enable the drive with range from >9Vdc to +30Vdc (min/max)	STANDARD
FAULT OUTPUT	Fault drive, open collector output 50mA max. (Normally closed, opens when in protection mode)	STANDARD
2 ANALOG OUTPUT	1 motor velocity monitor “TEST”, with range +/- 8 Vdc output 1 current monitor "CURR", with range +/-7 Vdc output	STANDARD
LED INDICATOR	Five LEDs are located just in front of the potentiometers and show the current state of the drive	STANDARD

Velocity feedback

Closing the velocity feedback loop to motor may be done in several different ways to accommodate most applications.

- DC Brushless motor with Hall effect (internal PWM Armature)
- DC Brushless motor with Hall effect + encoder

1.3 Characteristics

*

Type	Supply voltage (Vdc)	Rated voltage (Vdc)	Rated current (A)	Peak currentt (A)
BLD10	20 – 84 *	65	10	20 **

(*) Minimum and maximum voltage

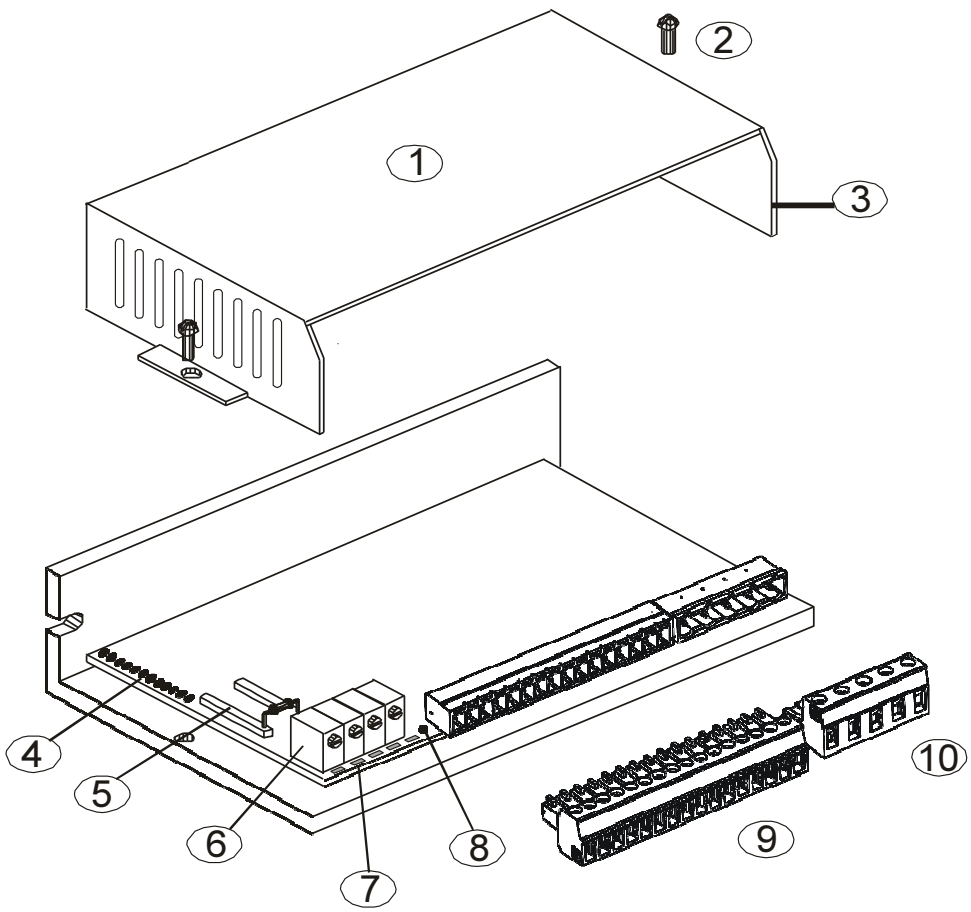
(**) peak current lasts 2sec

Main technical data

FEATURE	VALUE
Supply voltage output	0,9 * Vdc input
PWM frequency	20Khz
Operating temperature	0/+40°C
Storage temperature	-10/+70°C
Drift analog input	+/- 0,5uV/°C
Analog inputs (+/-VEL)	+/-10Vdc max, impedance 20Kohm each.
Current monitor output (CURR)	+/- 7Vdc = peak current
Velocity monitor output (TP1)	+/- 8Vdc = max speed
Power supply output (+5V)	+5Vdc max 130 mA
Power supply output (+/-9,8V)	+/-10Vdc max. 4mA
Encoder max. frequency	300Khz with level ≥+2,8/24Vdc min/max
Fault drive output	NPN max. 50mA
Start input	+9V/+30Vdc (min/max)
Band width (current)	2KHz
Band width (velocity)	150Hz
Minimum Inductance motor	400uH
Weight	0,35 kg (10.6 OZ)
Altitude	Up to 1000m without restrictions, from 1000 to 2000m power derating 1,5%/100m

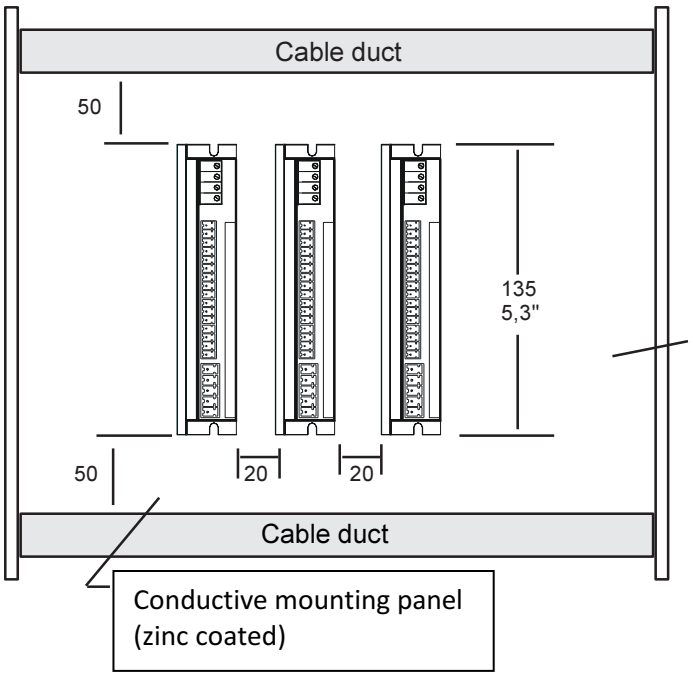
1.4 Product view

(1) Product Label
(2) Fixing screws
(3) Cover
(4) Solder bridges
(5) Adjustment zone
(6) N°4 calibration trimmers
(7) LEDs
(8) TEST point (Encoder, Armature velocity)
(9) M1 Signal terminal 16 pins MC1,5/16-ST-3,81 (pitch 3,81)
(10) POWER Terminal 5 pins GMST 2.5/5-G-5,08 (pitch 5,08)



This image does not faithfully reproduce the product, has purpose just for showing the parts

1.5 Ambient conditions



Positioning in the electrical box

Follow the instructions in the positioning of the servodrive into the electrical box.
- The drive is naturally convection air flowcooled.
- To ensure the drive cooling and make the installation easier for the operator it must be installed vertically leaving a free space of at least 20 mm (0,78 inch) on each side of the device. The converter must be mounted vertically on the electrical box. In case you want to mount it horizontally, remove the cover.
- The electrical box must have suitably filtered air vents.
- Leave the necessary space both above and below the converters.
- Keep the drive from excessive mechanical vibration

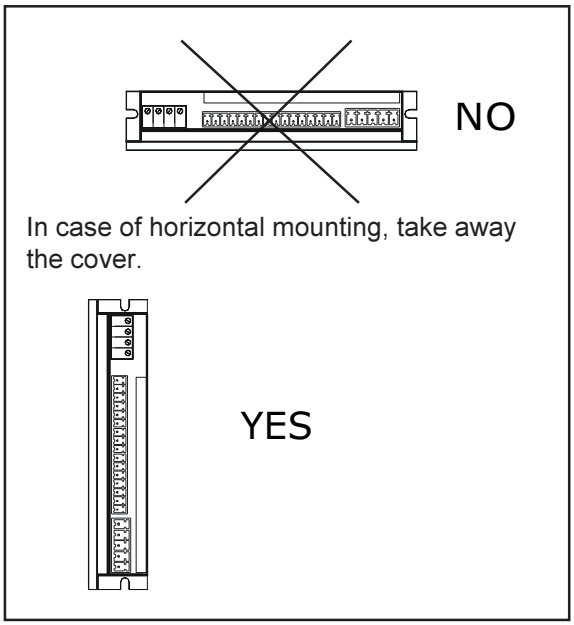
Notesduringtheassembly

Caution: during the wiring of the servodrive in the electrical box, make sure that do not enter leading wires of copper or iron chips through the slits. Before performing the work cover the holes with a piece of paper tape. Of course,after work it must be removed.

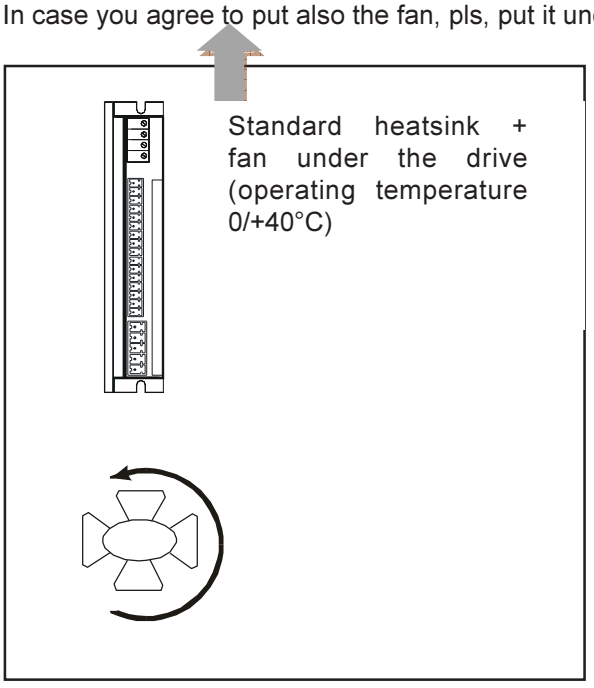
1.6 Ventilation

This servodrives are intended only for use in close locations. Ambient characteristics: operating temperature from 0 to +40°C. Humidity limit s between 5% to 95% non condensing (Pollution degree 2 or better).

Mounting position



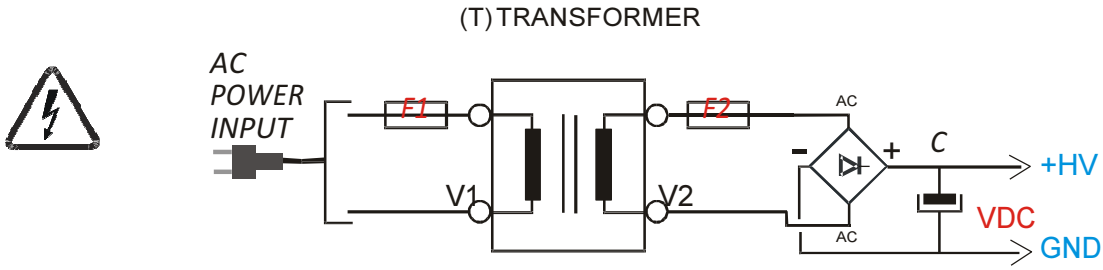
In case you agree to put also the fan, pls, put it under the drive



1.7 Power supply construction

Normally the power supply is built by a transformer, a bridge rectifier and a filter capacity. Alternatively, the power supply can also be of switching type, in this case refer factory by the appropriate sizing. The converter have to be supplied from an isolating rectified transformer secondary or a DC isolated power supply.

Transformer



Voltage:
The primary voltage depends on what is available locally for a single phase. The secondary voltage is calculated from the motor's voltage at the required operating speed.
The secondary voltage VDC is:

VDC = V2 * 1,41

Example: If the secondary transformer V2 is 45Vac, the VDC output is 45*1,41=64Vdc

PAY ATTENTION:
- The drive has zero signal GND in conjunction with the zero power GND, thereby preventing the following links:
- Use a standard heavy duty power transformer without center taps on the secondary as shown in the schematic above.
- DO NOT USE AN AUTOTRANSFORMER.

Power transformer (T)

The transformer's nominal power is calculated based upon the sum of power from the single motors driven:

P(VA)=Pn1+Pn2+..

Pn Motor = N * Cn / 9,55

Where: **Pn Motor** = Power absorbed motor in (W)
N = Max. speed of motor in RPM.
Cn = Nominal torque of motor in (Nm).

Note: In multi-axis applications, the transformer's power can be downgraded by 30%. If the max. power transformer calculated is over 6KVA contact the factory.

Motor voltage

If the secondary voltage of power supply is VDC, the Vdc motor is calculated by the formula:

VDC = Vdc motor / 0,83

Where the Vdc motor is a sum of FCEM + the drop R*I for the winding resistance motor

Vdc motor = E+(Ri * In)

The FCEM of the motor "E", may be calculated by the formula: **E = Ke * N° / 1000**

Example: Brushless motor with the following data:

In =5 (A)
Ri = 1 (Ohm)
E=48 (V) at nominal speed 3000 (RPM)

Vdc motor = 48 + (1 * 5) = 53V

VDC = 53 / 0,83 = 63,8V

63,8V is the **VDC** voltage request for the power supply. You'll use a transformer with the secondary **V2** = 64 / 1,41= 45Vac
When you use the transformer with V2= 44/45Vac, it is correct.

Misure unit:
E = Ke *n°/1000 (Vdc)
Im = I motor (A)
Ri = Winding resistance (Ohm)
Ke =Voltage constant (V/kRPM)
n° = MAX speed(RPM)

Capacitor filter(C)

In regards to the capacitor filter we suggest a working voltage of:
*100VDC
*Tipical value is from 4700uF to 10.000uF (depending on the motor size and kind of application)

Capacity above the filter effect, helps to recover energy during braking of the motor.
If the converter during braking has the green LED that flashes you must increase the value of the capacitor (eg. 10.000uF from a 20.000uF)

Fuses (F1) e(F2)

Fuses are required on both the primary and secondary of the transformer to protect against harm to the system and the transformer itself. They need to be of the slow blow type to handle current in-rush at power-up. Locate the primary fuse (F1) on the hot leg of the AC input power and the secondary fuse (F2) on the + side of the secondary output, before the rectifier.

Primary of the transformer, use the formula below to calculate the correct values:

F1 (A) = P (VA) trasfo. / V1

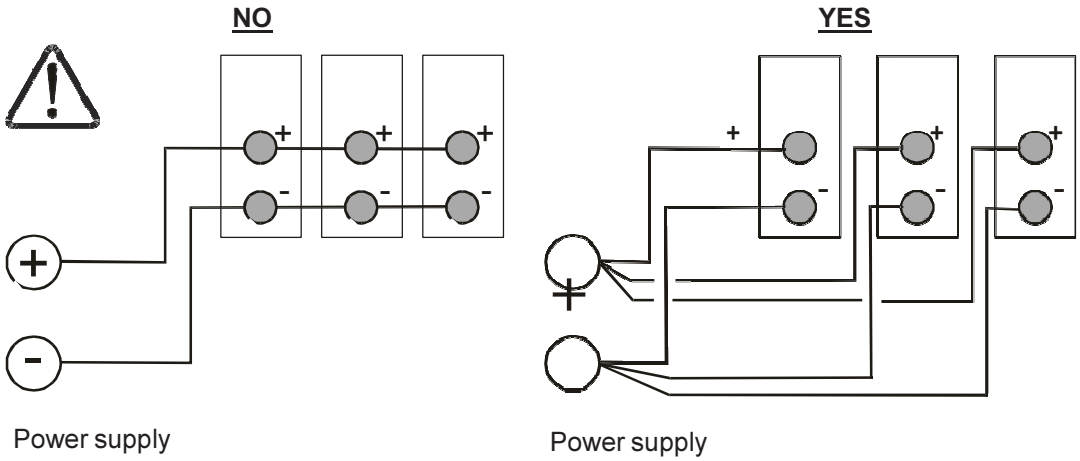
Secondary of the transformer: Use the table below

FUSE F2 (A)	MOTOR TYPE
12	BL0120.240, BL180.240, BLS022.240, BL025.24E, BL032.240, BL043.240, BLS043.240
16	BL070.480, BL070.48E

1.8 Note about connections

Multiple connection

In the case of multiple servodrives on the same power supply, make connections-type stars, see drawing back. Connect also feed converters using the shortest cable possible. If the cable length exceeds 2m, twist the + and - leads together as twisted pairs.



The drives have to be supplied from an isolating rectified transformer secondary or a DC isolated power supply.

EMC note

The conformity is assured only if it is installed following the precise assembly criteria expressed below. The fundamental assembly characteristics are summarized below:

* The correct ground connection of predisposed parts.

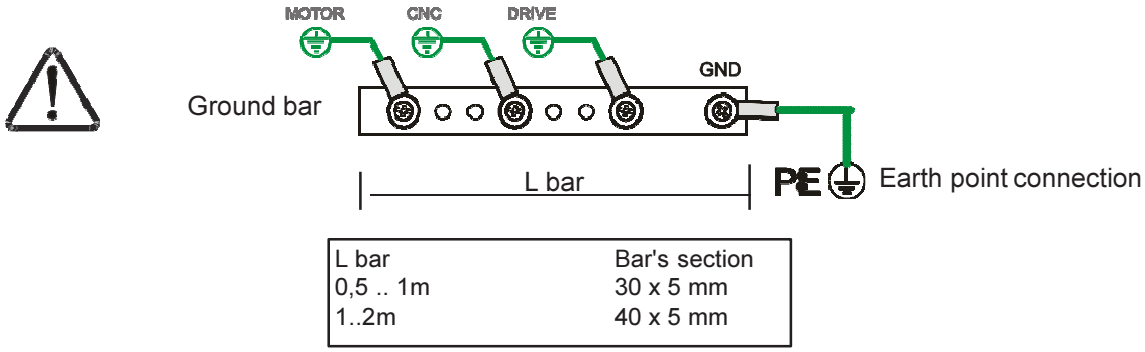
* Using the division of cables technique. Separate power cables from signal cables.

* Use of shielded cables, both for power connection (to the transformer and the motor), and for signal connection (also to the controller).

* Use of appropriate network to filter the line (transformer input), from disturbances conducted or produced by the drive. (series of filters released are available for this purpose).

1.9 Connection to earth and ground

Make sure that the servodrive and the motor are connected to earth in accordance with the current norms. This connection must be done by using a copper bar, mounted on insulating supports.



L bar	Bar's section
0,5 .. 1m	30 x 5 mm
1..2m	40 x 5 mm

then follow these indications:

1. Connect to the ground bar:
   the internal "0V" zero voltage of the CNC; the earth terminals of the PLC/CNC frames; the "0V" of the auxiliary supply;
   the CHASSIS of all drives;
2. Connect the ground bar to the zinced panel of the drive by using a screw, then connect that screw to earth.
3. Connect earth to the motor's

It suggests a conductive connection as much as possible to the chassis, or the heatsink, or the mounting panel of the electrical box.

It refers to the earth connection.

Motor and Power cable (as norm EN60204), in case of needing to have longer cable than standard ones

WIRES SECTIN	MOTOR TYPE
1,5mm² / 15AWG	BL012.240, BL018.240, BLS022.240, BL025.24E, BL032.240, BL043.240, BLS043.240
2,5mm2 / 13-14AWG	BL070.480, BL070.48E

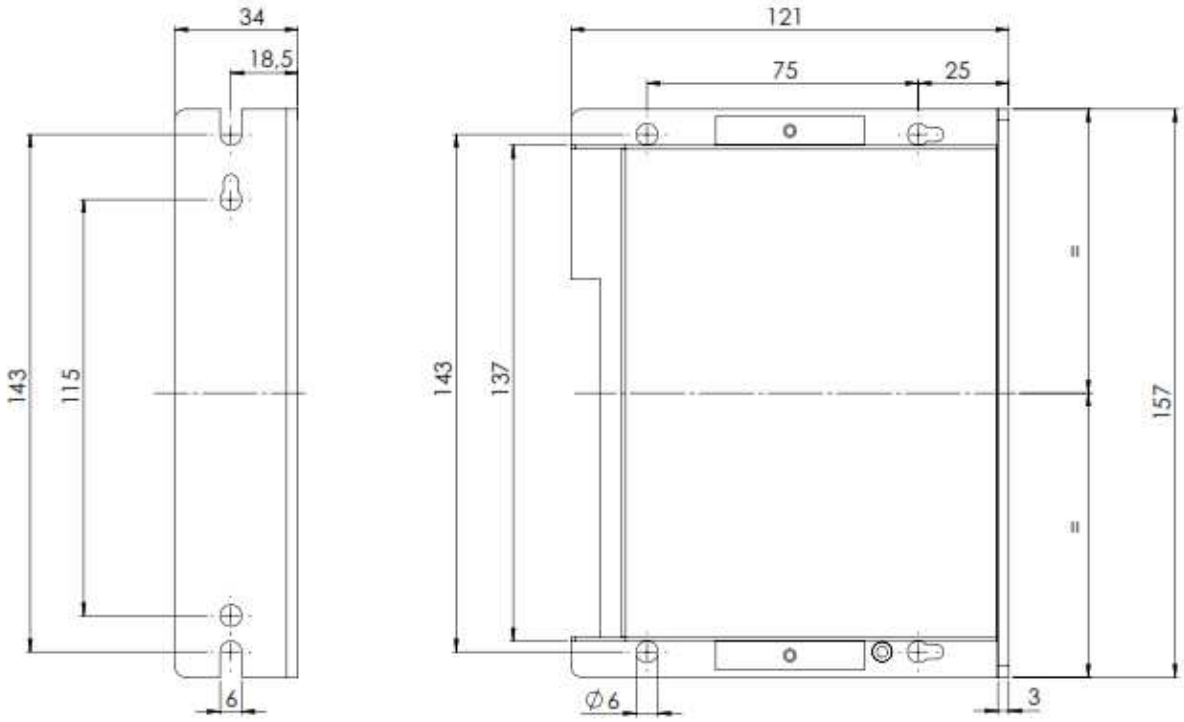
Control signals cable (as norm EN60204)

WIRES SECTION
0,5mm² / 20AWG

Feedback signals cable (as norm EN60204)

WIRES SECTION
0,25 - 0,35mm2 / 22 -24AWG

1.10 Dimensions



1.11 Pin out overview

Pin out view

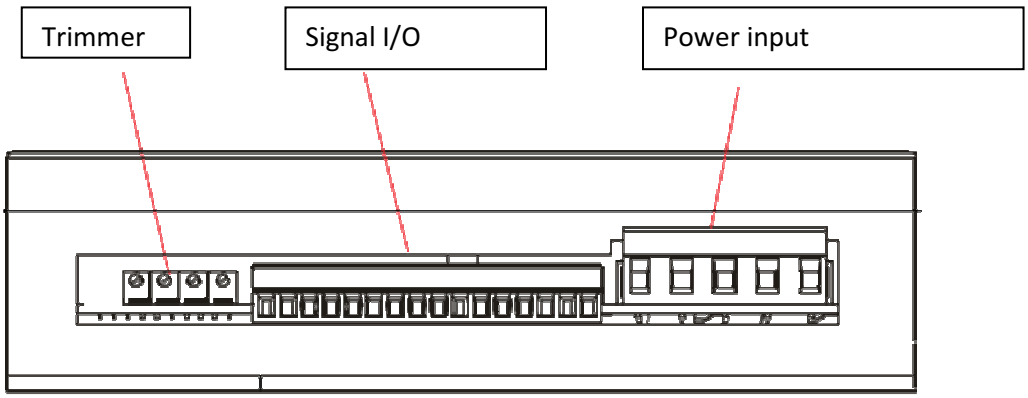
The figure below shows the view of the converter terminals.

M1 Signal terminal 16 pins "type MC 1,5/16-ST-3,81" POWER
Terminals 5 pins "type GMST 2,5/5-G-5,08"

On the test point "TEST" you can see the signal of speed. The output from 0 to + /-8V is from zero to maximum speed. At this point you can analyze the signal when you enable one of the following velocity feedback.

- Encoder
- Armature

NOTE: Depending on the type of motor to drive, follow the links relating to such applications.



Power terminals

POWER CONNECTOR	
+HV (IN)	Positive Power supply input
GND (IN)	Negative Power Supply input (GND)
U (OUT)	Motor connection U phase
V (OUT)	Motor connection V phase
W (OUT)	Motor connection W phase

NOTE: pls, read also the connection diagrams of the following chapters.

Signal inputs and outputs

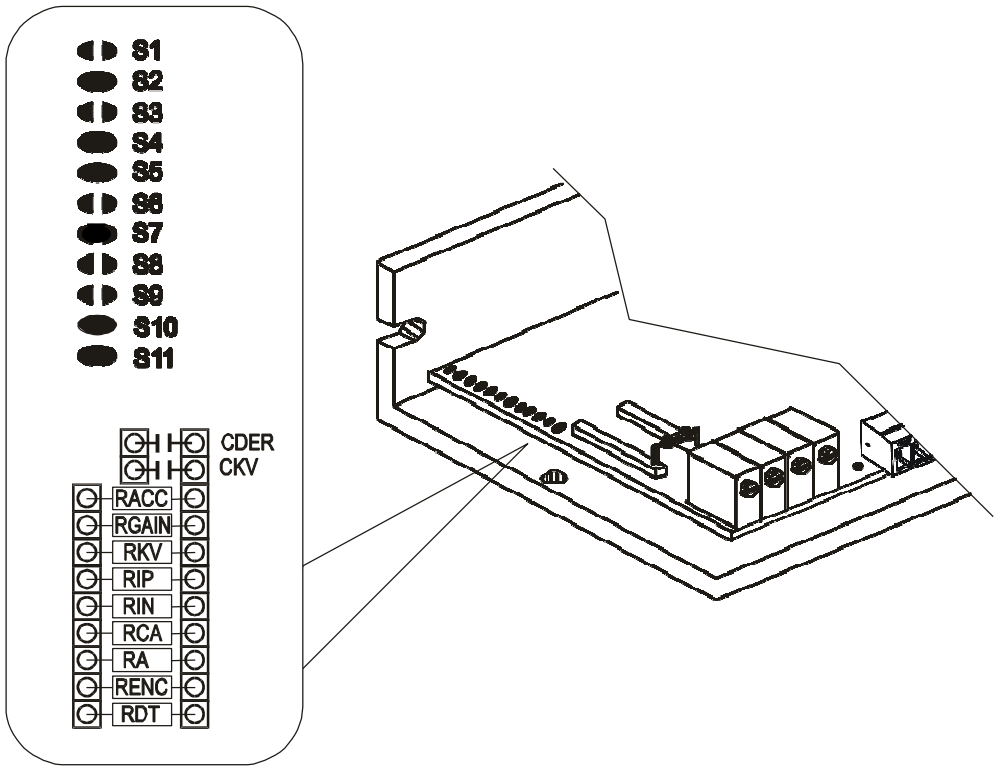
M1	
1 CURR / IN2	This signal can be used in 2 distinct modes: Current motor monitor (OUT): +/-3.5Vdc=Rated current, +/-7Vdc=Peak current output in Volts. This output may be used to monitor the torque the motor is producing (Standard setting) IN2 setting (IN): Is possible setting this terminal for Limit sw input (contact Intecno)
2 FAULT (OUT)	Fault drive, open collector output max. 50mA **Normally closed, opens when the drive in protection mode**
3 REQ / IN1	REQ:, can be used in 2 distinct modes: 1) Motor Current limit mode (by REQ setting): A motor current limit mode connect an external resistor to GND reduces the maximun current. Connect a 1/4W o 1/8W resistor between the TPRC (pin 3) and GND (pin 4) terminals. A 47Kohm external resistor reduces the current by 50%. (Note: The drive speed loop remains active) 2) Torque request (by REQ setting): Range: +/- 10V, which corresponds to the drives peak current output. In this mode the speed loop is automatically disabled. IN1 setting (IN): It's possible to set this terminal for Limit sw input (contact factory)
4 GND	Signal Common Ground It corrisponds to power supply's negative GND input
5 +10V (OUT)	Power supply +10Vdc max 4mA
6 –10V (OUT)	Power supply –10Vdc max 4mA
7 START (IN)	Positive drive enable, with range ≥+9Vdc min. to +30Vdc max
8 +VEL (IN)	Reference Positive differential input (Speed command)
9 -VEL (IN)	Reference Negative differential input (Speed command)
10 ENC A	Encoder input Channel A (High logic level from ≥2,8V to +24Vdc max. Low logic level ≤1,5V).
11 ENC B (IN)	Encoder input Channel B (High logic level from ≥2,8V to +24Vdc max. Low logic level ≤1,5V)
12 +V (OUT)	Power supply +5V max. 130mA
13 GND	Signal Common Ground. It corrisponds to power supply's negative GND input
14 HALL 1 (IN) **15 HALL 2 (IN)** **16 HALL 3 (IN)**	Hall Sensor inputs from the motor. Each input has a pull-up resistor of 1 Kohm to internal +5V (High logic level ≥3,2V , Low logic level ≤1,5V)

1.12 Internal adjustements

If changes need to made to the internal drive setting powering, please wait at least 30 seconds after the power has been removed and the OK LED is off.
All of the personalizations are located inside of the DRIVE. (See figure above)
To get the access to the adjustment pads and the Solder bridges, unscrew and remove the cover.

Solder point standard configuration

Solder bridges standard position are setting by factory for:
- Brushless setting
- Hall sensor feedback
- Ramp time disabled
- Standard Dynamic constant



Adjustement zone

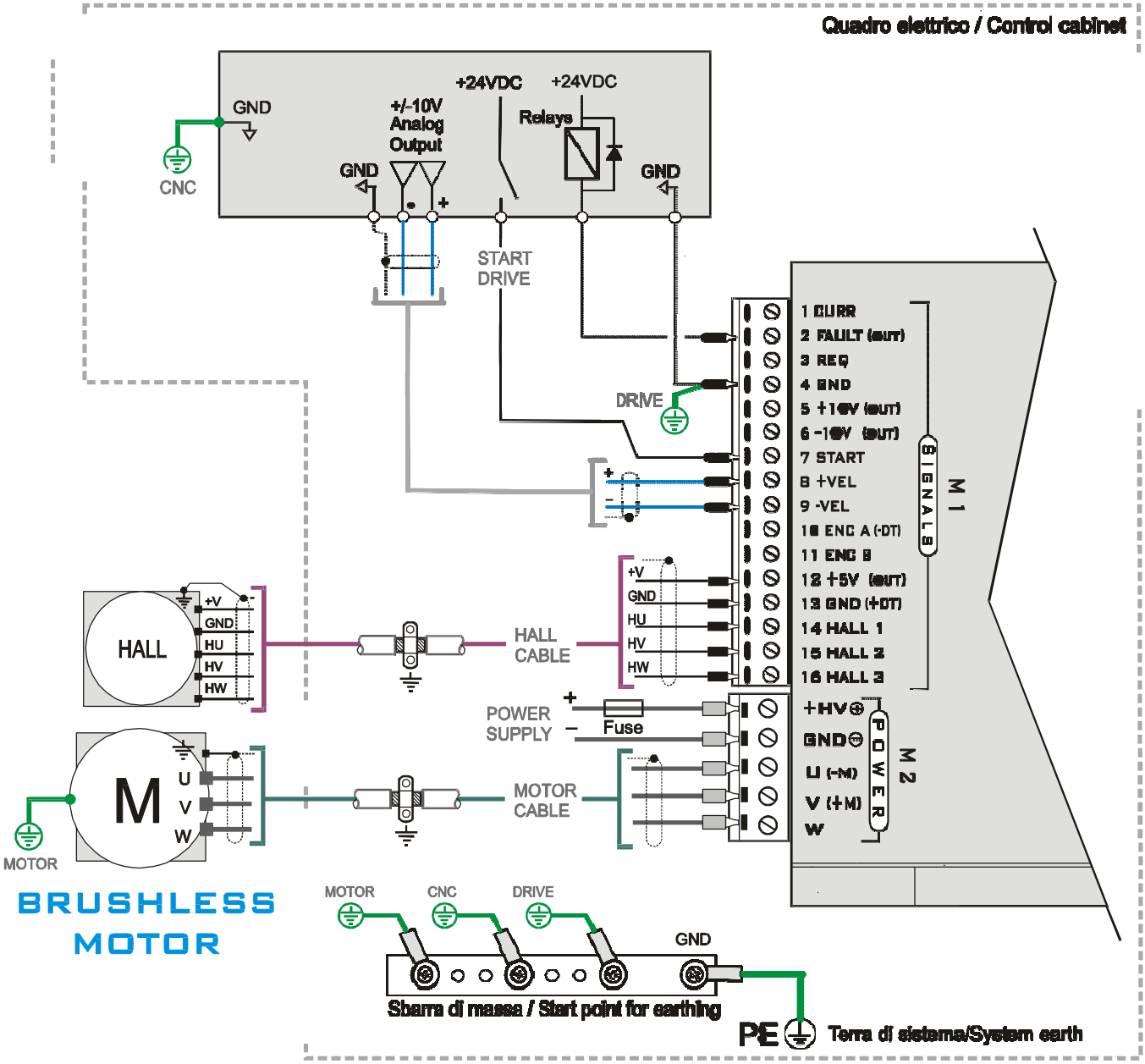
FEATURES	
RDT	Non used
RENC	Encoder resistor adjustement
RA	Armature resistor adjustement
RCA	Drop compensation for internal motor resistance (RI)
RIN	Drive rated current resistor
RIP	Drive peak current resistor
RKV	Resistor value that respectively form the proportional/integral network of the velocity Loop gain. Disabled by opening solder bridge S4. Standard value 100k and 47nF.
GAIN	Changes static gain in the velocity loop. Open solder bridge S5 and insert RGAIN if a change is required. Consult factory for the correct value.
RACC	Resistor for setting acceleration time function. See Chapter 2.3
CKV	Capacitor value that respectively form the proportional/integral network of the velocity Loop gain. Disabled by opening solder bridge S4. Standard value 100k and 47nF.
CDER	Derivative constant capacitor, increases the velocity loop derivative constant. Consult factory for the correct value.

Solder bridges

Note: For any feedback available, are listed in the various chapters related settings (read chapters 2)

SOLDER BRIDGES	
1	**Normally open (OFF)**
2	**Normally closed (ON)** Don't touch
3	**Normally open (OFF)** See Chapter "Ramp time adjustment". If closed insert RACC resistor
4	**Normally closed (ON)** Open= install components in the adjustment zone, for the dynamic velocity value CKV and RKV. (Standard value RKV=100Kohm , CKV= 47nF).
5	**Normally closed (ON)** If Open you must insert the GAIN resistor. (Static Gain). Standard value= 27 ohm
6	**Normally open (OFF)** If closed, when the IxT protection operates the green led OK (and the output FAULT) goes off.
7	**Normally open (OFF)** If closed the drive is set is for the armature feedback. Insert also the resistance RA and RCA
8	**Normally closed (ON)** In this position the drive is set for the encoder feedback. If Open (OFF), other types of feedback are enabled
9	**Normally open (OFF)** If closed setting the drive for PWM+DIR command (optional)
10	**Normally closed (ON)** Open S10 (OFF) for tachogenerator feedback
11	**Normally closed (ON)** If open (OFF), the alarm protection for missing Hall Effect Signals will not disable the drive.

2.1 Brushless motor with hall signals

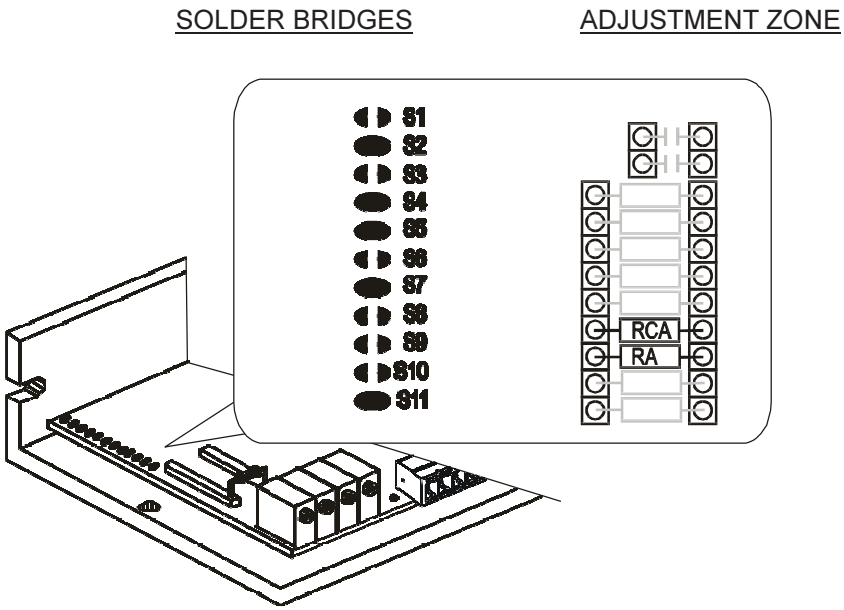


The following diagram shows a tipical application utilizing a Drive with Brushless motor (only Hall signals).

These signals are used in the converter for the control of current and to regulate motor speed. The adjustment range is lower than the use of 'Encoder + Hall, but good enough for many applications

Setting for Brushless motor with hall signals

In this configuration, BLD10 must set with the following Solder bridges and below internal setting:



Standard solder Bridges set for:

- Hall feedback (Armature)
- Ramp time disabled
- Standard Dynamic constant
- Brushless motor

For the correct value of RA and RCA resistor (speed adjustment range) see chapter 2.2

Note: On the adjustement zone the other components are not considered here, the ones used to determine other calibrations, for example. Calibration current rating etc.

2.2 Set up data for Intecno's motors

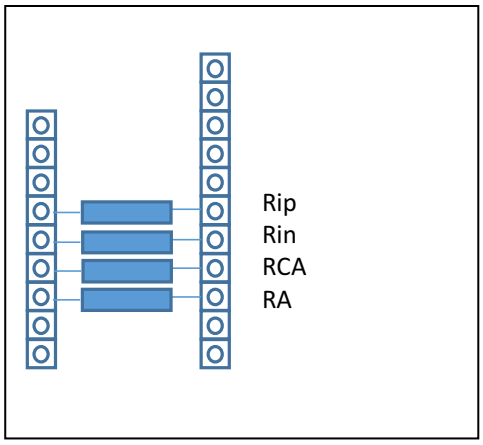
BLD10 is set up by default on the motor BL043240. Hall sensor feedback.
In order to set up the drive to other motors, pls, change the resistors as the table below.

BLD10 (basic = 10/20 A)

Motor type	Current [A] (rated/peak)	Motor voltage [V]*	Rin [Ohm]	Rip [Ohm]	RA [Ohm]	RCA [Ohm]
BL012 240	3,5/7	24	820R	27K	4K7	68K
BL018 240	5/10	24	1K5	47K	4K7	120K
BL022 240	7/14	24	3K9	120K	4K7	120K
BL025 24E	7/14	24	3K9	120K	4K7	180K
BL032 240	5/10	24/36	1K5	47K	8K2	150K
BL043 240	7/14	24/36	3K9	120K	8K2	220K
BLS043 240	7/14	24/36	3K9	120K	8K2	220K
BL070 480/48E	7.5/15	48	---	---	18K	470K

* Supply the drive with 5-6 Vdc more than the rated motor voltage.

Keys:
Rin = rated current limit resistor
Rip = peak current limit resistor
RCA = voltage drop calibration resistor
RA= max speed calibration resistor

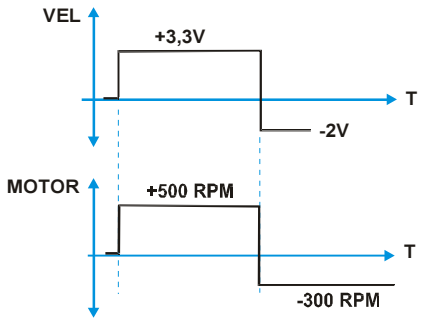


See Appendix A (page 37) the decoding of the values of resistances by the method of colored rings.

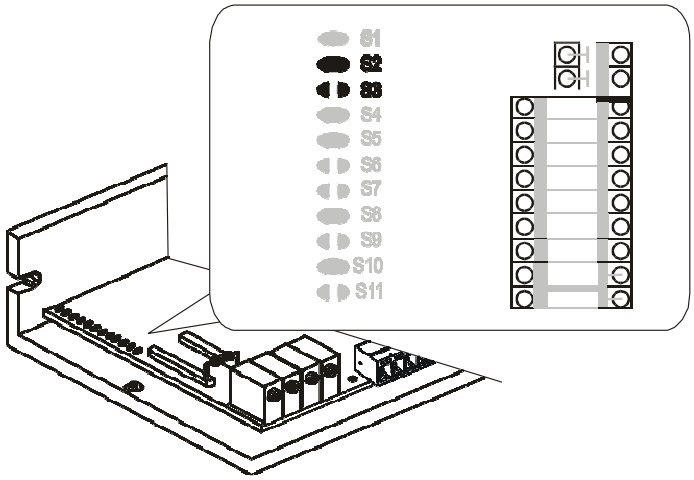
2.3 Ramp time adjustements

The product is (standard) set with this feature not enabled (Section S3 open)
To enable the ramp acceleration, close the solder bridge S3 and insert the RACC resistance. NOTE: The product issupplied by default with mounted 470ohm resistance value (0.8 sec ramp)

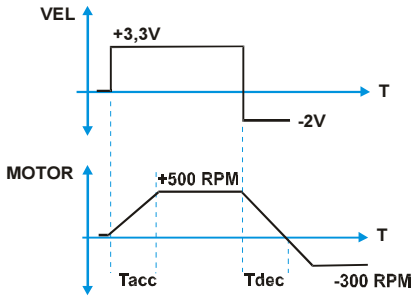
Ramp disabled (standard setting)



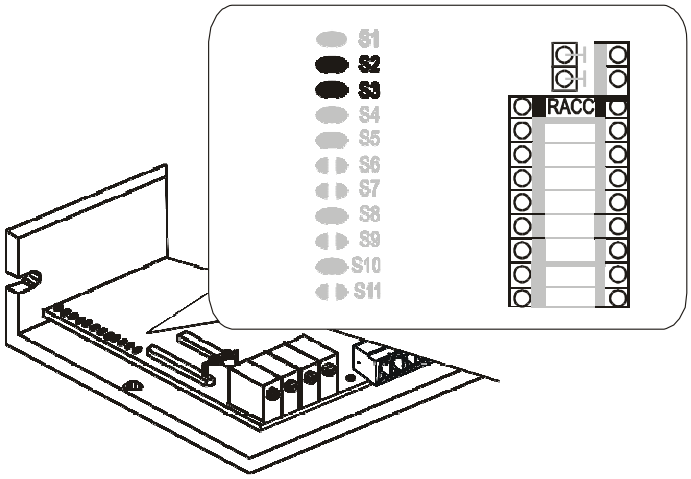
Ramp disabled



Ramp enabled



Ramp enabled



Table

The time shown on the right are related to a change to step on the reference signal input + /-VEL of 10V. Example from 0 to 10V or 10 to 0V

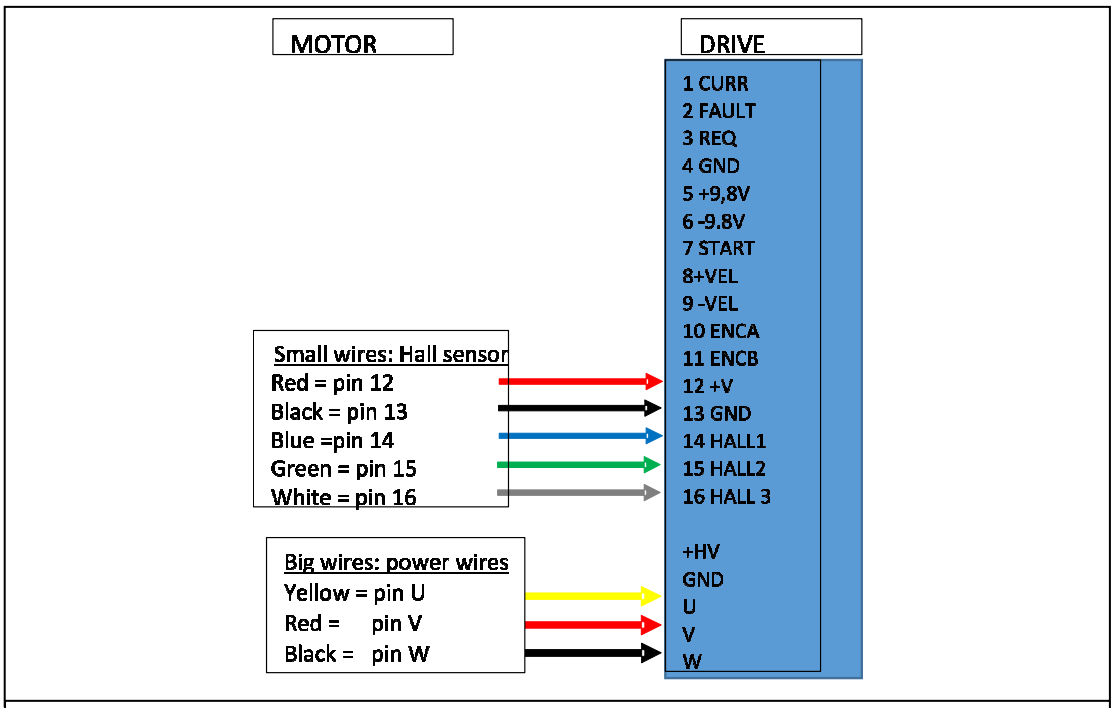
Resistance (ohm)	TIME (seconds)
27 Ohm	15
68 Ohm	5
100 Ohm	3,16
470 Ohm	0,8
1K Ohm	0,32
1,5K Ohm	0,26
3,3K Ohm	0,16
10K Ohm	0,086

2.4 Intecno's motors connection

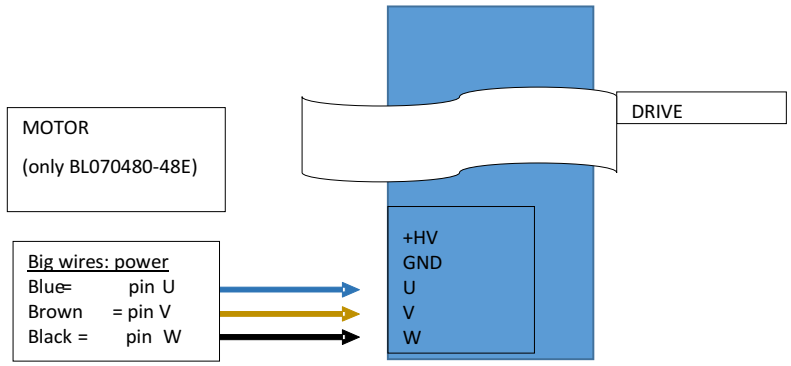
Pls, follow the drawing:

Power wires (bigger section)
Yellow big (or **blue**) phase motor U : pin U
Red big (or **brown**) phase motor V : pin V
Black big phase motor W : pin W

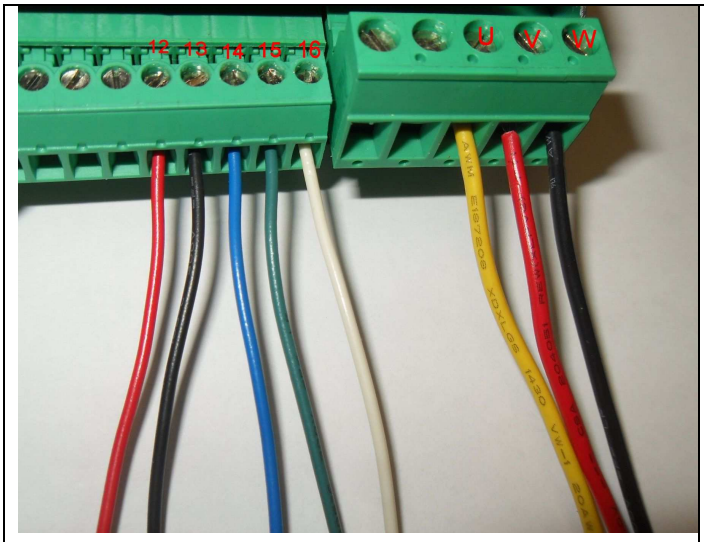
Signal wires (smaller section):
Red small (+Vdc) : pin 12
Black small (GND) : pin 13
Blue (hall U) : pin 14
Green (hall V) : pin 15
White (hall W) : pin 16

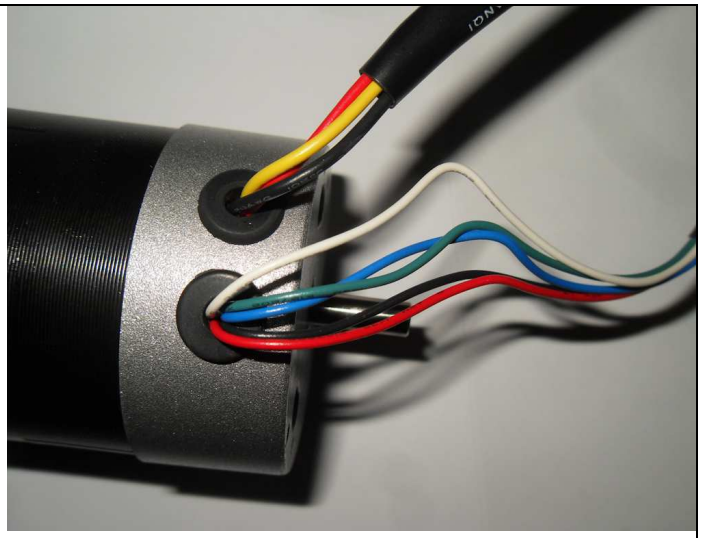


Just for motor BL070480/BL07048E, power wires colors can be different, but the signal wires' colors are the same as the other motors



Connection picture as per example. Use shielded wires in case you need longer wires.





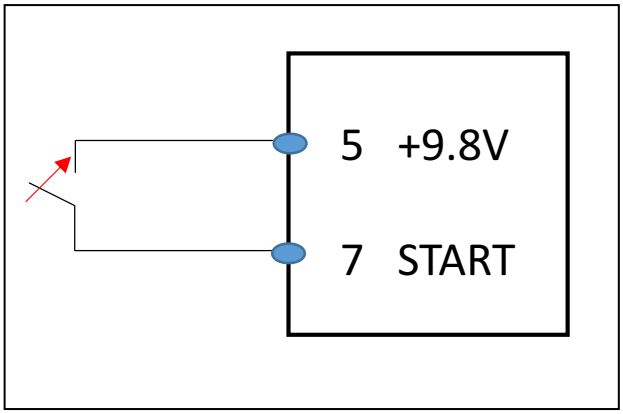
2.5 HW direction selection

In order to get the change of direction of the motor, without using the feature of inversion by the drive, the user can procede as follows:

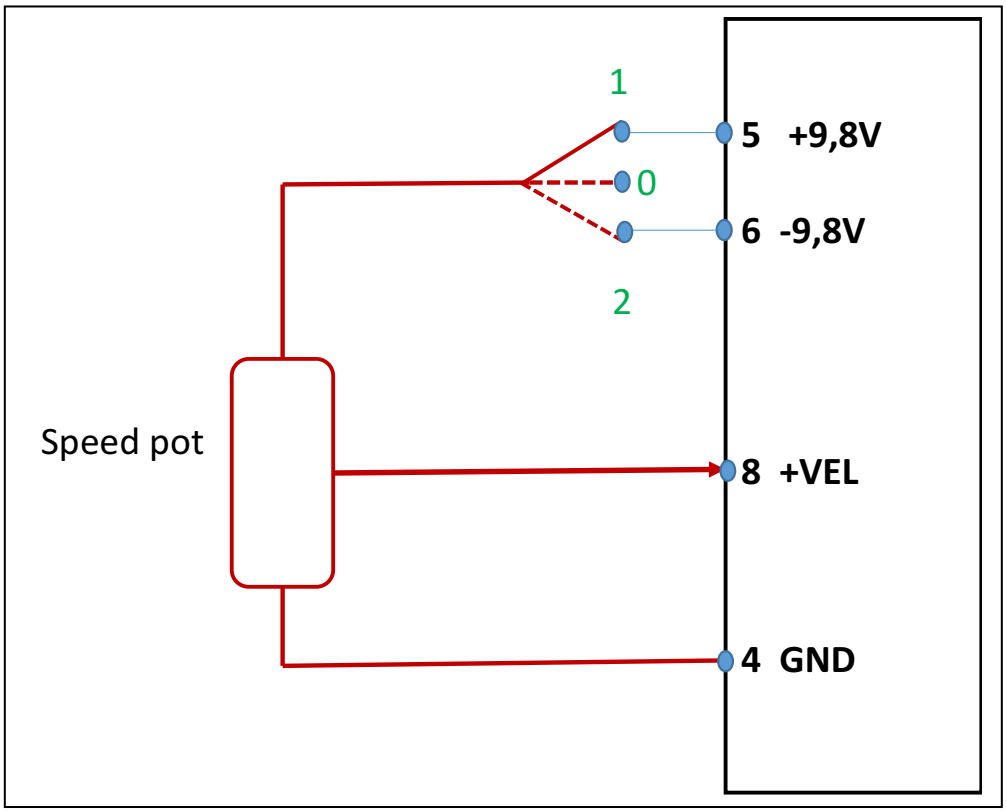
a) Change each other the position of the motor phases U and V (yellow with red)
   And at the same time:
b) Change each other the wires of the Hall signal pin 14 and pin 16 (blue with white)

2.6 Basic command diagram

NOTE: close pin 7 onto pin 5 (or connect to pin 7 a voltage from 10 to 24 Vdc). This enables the motor to run as per speed selected by the speed pot. Start pin does not meet the ramp (even if the ramp is enabled). Opening pin 7, the motor stops by coast.



The simpliest basic connection is the following:



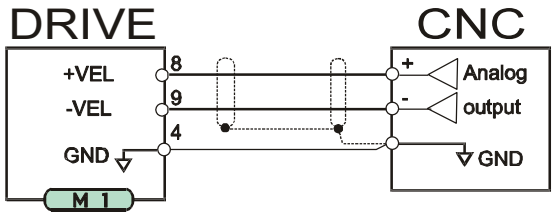
10 KOhm speed pot, the central pin (the one that changes) connected to pin 8 (+VEL), one of the external pins to the pin 4 (GND) and the other to a 3-ways selector, that is connected itself as per the picture.
0 = stop
1 = run forward
2 = run reverse

Speed is managed by the speed pot, the direction by the polarity of the selector.

2.7 *Analog speed input*

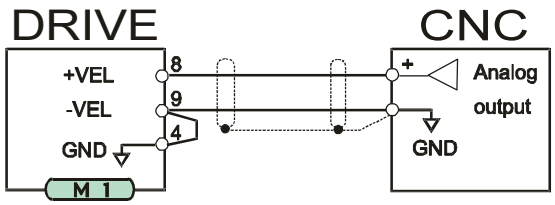
Differential reference

(+/-VEL) This analog in differential mode has a 40Kohm of impedance input.
The following diagram shows an application utilizing a **differential reference** from a C.N.C



Common mode reference

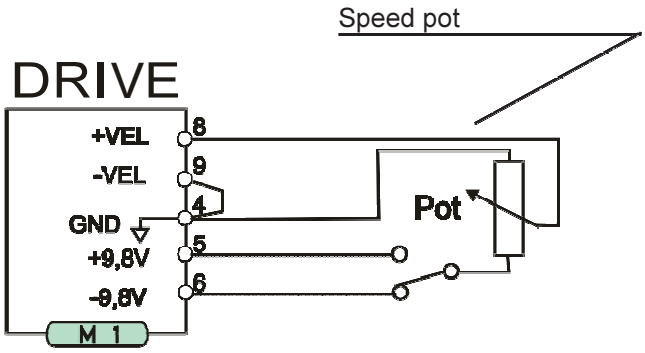
This analog in common mode has a 20Kohm of impedance input.
The following diagram shows an application using speed reference connections from C.N.C in the Common Mode.



Speed reference from external potentiometer

The following figure shows an application with speed reference connections using an internal +/-10V power supply.

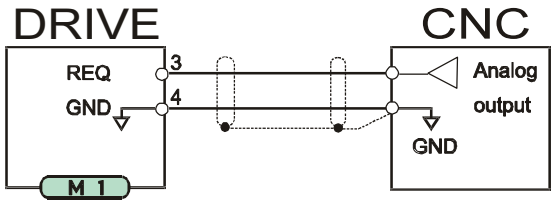
The speed potentiometer must have an included value between >5 and <10Kohm.



2.8 REQ torque input

Current command mode

With a voltage (example from a CNC output) you can command the drive in torque mode.



Applying a signal of +/-10V at TPRC, the user enables the drive to supply positive or negative peak current.
The formula to determine the value of Voltage to apply in TPRC in order to obtain requested current is the following:

V(TPRC) = 10 * Request current / PKcurrent Drive

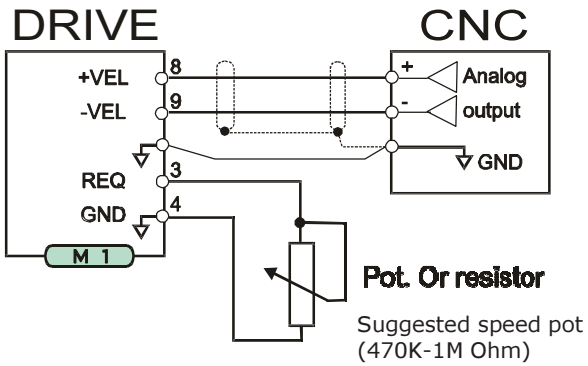
Example: (Drive size 10/20A, request current 8A)

V(TPRC) = 10 * 8 / 20 = 4V

NOTE:
In current reference the loop of internal speed is automatically excluded.
In order to get a current +8A a voltage -4V in REQ pin must be applied, in order to get a current -8A a voltage +4V must be applied.
Non apply voltage more than ± 10Vdc on REQ pin.

Current limit mode

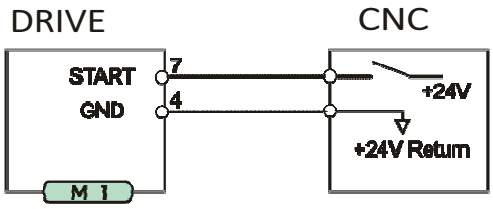
With an external potentiometer connected from GND and TPRC input, you have a limitation of output current (from zero to max. size) drive's.



The speed ring remains active and uses the input reference signal. In this case the loop of internal velocity remains active.
Applying and eternal resistance tending to zero Ohm, allocable current tends to zero. Encreasing he resistance, allocable current encreases too. 47Kohm current is limited by 50%
Speed loop is active.

2.9 Start input

The standard drive is supplied in this configuration.
Start enable input has logic range: ≥+9V to +30Vdc (min/max)



Unconnected Enable input = Drive Not Enabled
Enable Input +24Vdc = Drive Enabled

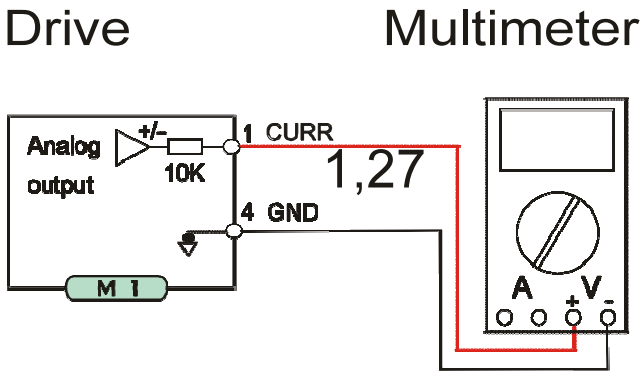
Is possible to enable the drive connecting the START input to +10V output "terminal 5"

2.10 Current monitor output

CURR analog output (pin1)

On this terminal is available analog output "current monitor of motor" with range 0V + /-7V. The value of 7 V is the maximum current supplied by the drive. For example, if we have a size 10/20A, 7V corresponds at 20A circulating on the motor.
The signal can be positive or negative depending on the direction of rotation of the motor.

Output Impedance is 10Kohm. Consider the internal impedance in the case are linked external resistive divider.



Note:

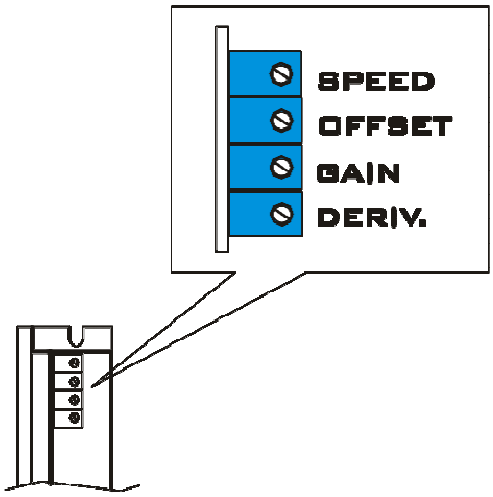
Standard product is set to the signal CURR on terminal 1 (reading of the current circulating on the motor) and the REQ input at terminal 3.
If these signals are not used, you can use these terminals for two other control functions named IN1 and IN2.
Through the inputs IN1 and IN2 (when set) you can limit the motor torque in the two respective directions of rotation of the motor (CW and CCW). Can therefore be used as limits Overtravel left and right.
Ask how to set these inputs in the factory.

3.1 Speed offset adjustments

For this adjustment both Hall and Encoder signals are required.

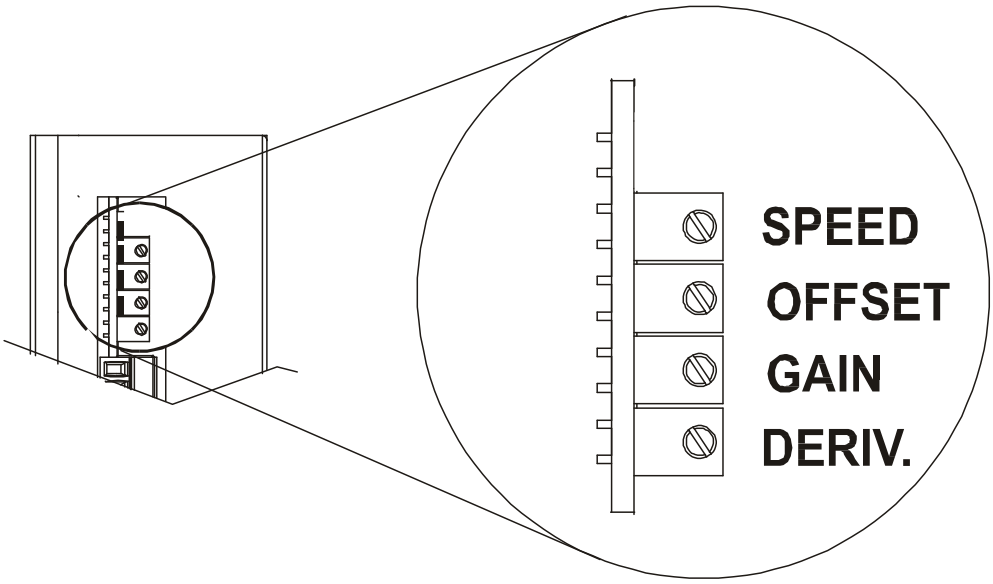
The converter is supplied with zero adjustment already performed in encoder feedback. If necessary, turn the Offset trimmer, to correct any offset error. (It makes up approximately +/- 200mV on the reference input +/- VEL). With the reference input to zero, turn the trimmer, till to stop the motor.

This calibration works with any type of speed feedback adopted



3.2 Trimmer adjustments

The converter is equipped with 4 trimmer with the following meanings:



FEATURES

SPEED	**Motor fine speed calibration.** With rotating clockwise (CW) or counterclockwise (CCW) is possible increase / decrease the speed of the motor with range + / -25%
OFFSET	**Offset adjustment.** Allows the balance to zero motor speed. Adjust this potentiometer to cancel any motor speed offset when the Velocity input is zero.
GAIN	**Gain potentiometer.** This adjustment improves the dynamic behavior of the motor. With a clockwise (CW) we increase the readiness and response of the motor. With a clockwise turn (CW) we increase the gain of the PI "internal speed loop".
DERIV.	**Derivative potentiometer.** Acting in a clockwise (CW) can dampen any oscillations of the motor due to a high moment of inertia of the load.

In Chapter 3.3 explains how to dynamically tune the motor by acting on the 2 trimmer GAIN and DERIV.

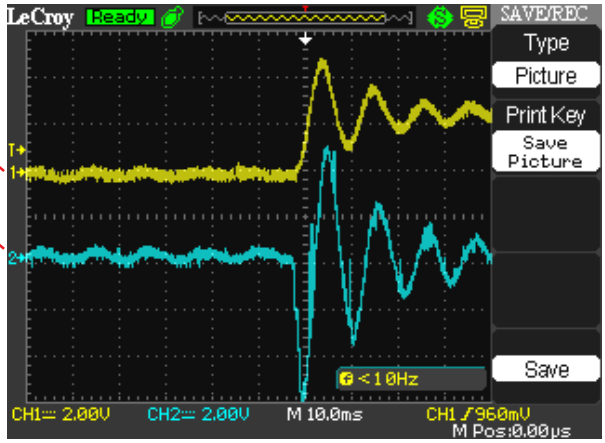
All potentiometers are disabled in Torque mode

3.3 Dynamic adjustments

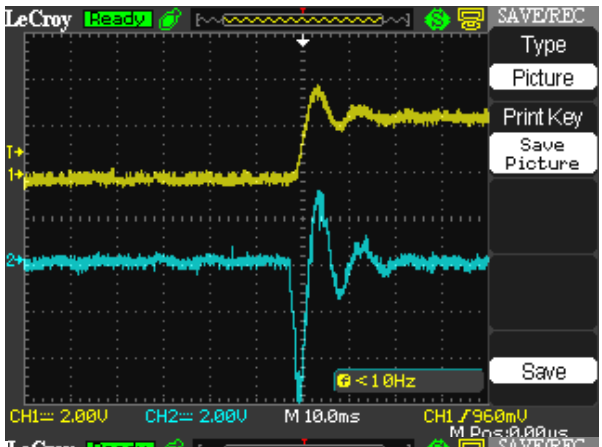
The multi-turn GAIN and DERIV trimmer allow to dynamically tune of the motor and its mechanics linked to it. These trimmers have full excursion from minimum to maximum, with 15 turns of rotation of the same.
The charts shown the track 1 "yellow" is the speed signal available in the point TEST. Track 2 blue highlights instead the current signal taken at terminal 1 (M1 signals connector pitch 3.81)
Signals are reported with a step voltage of the reference signal speed of about 2V.
These signals can be displayed by connecting the two probes of an oscilloscope at those points. The zero signal 0S (zero probes) can be connected by a wire to pin 4 (M1 signals connector pitch 3.81)
.

Speed signal

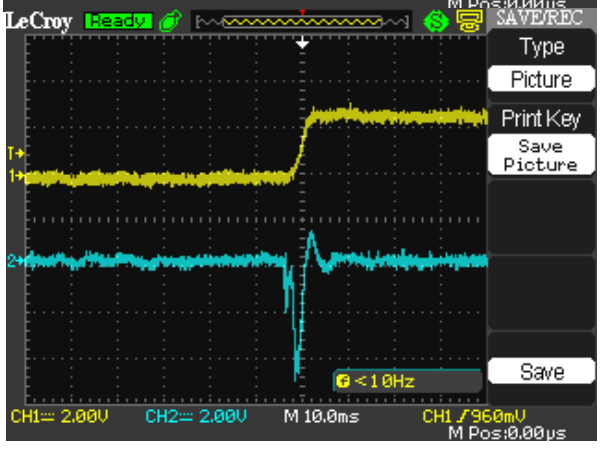
Current signal



Behavior of the motor with both GAIN and DERIVATIVES trimmer to a minimum of function (trimmer totally rotated counterclockwise CCW). The speed signal is unstable, the same for the current signal of themotor. See chart at right



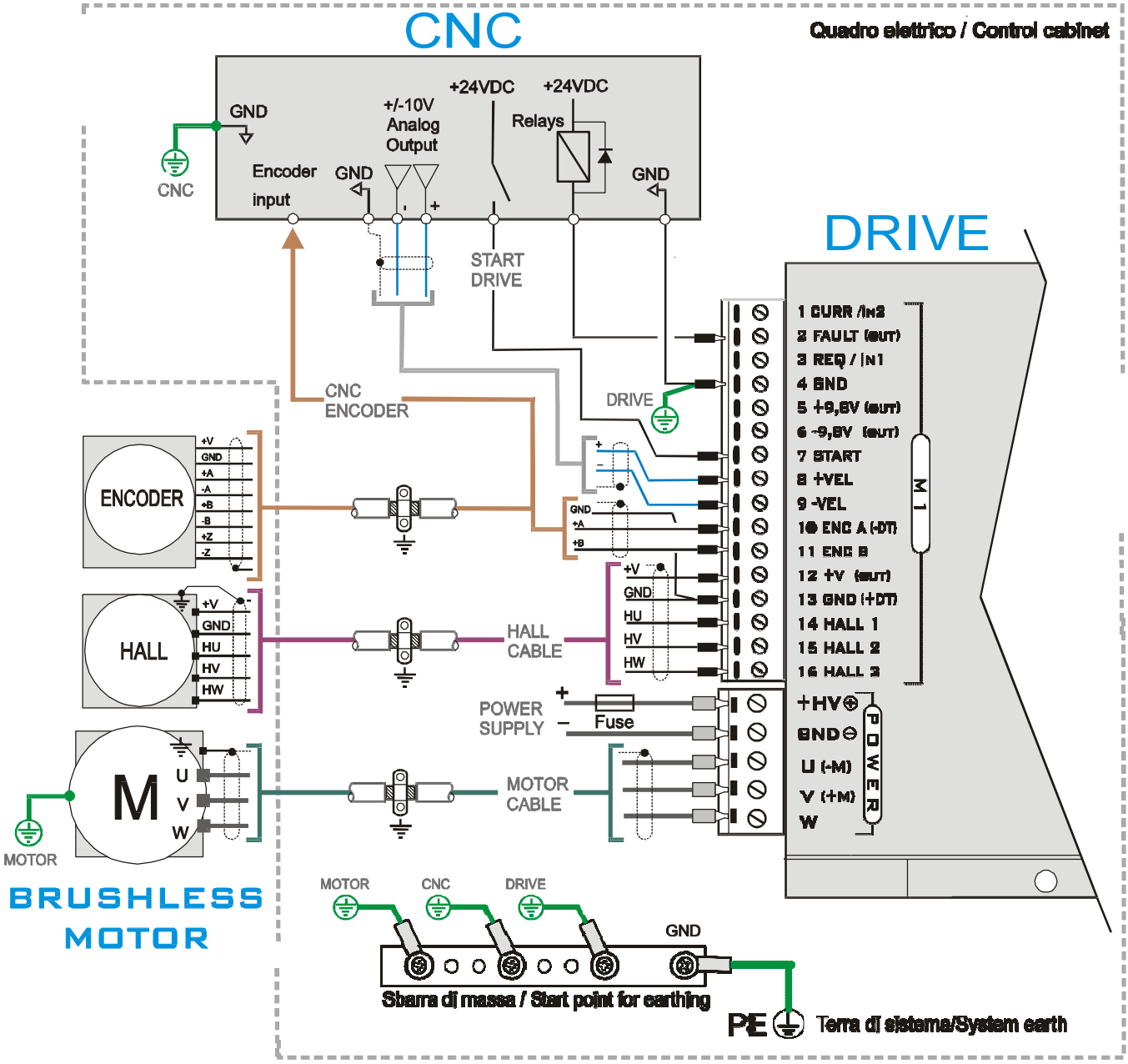
Turning clockwise CW the trimmer GAIN (4 / 5 turns) the dynamic behavior improves, not exceed with this adjustement, otherwise the motor will be vibrating. See chart at right



To improve the behavior of the motor and mechanics related to it and the over all damping of the speed signal oscillation , act trimmer DERIV. turning it clockwise CW (4 / 5 turns). See chart at right

NOTE: The dynamic calibrations are performed using a reference speed (in + /-VEL) of about 1 or 2V. You can use the voltage output from the CNC control, paying attention to rule out the correction of space. Or use an external oscillator or a small battery 1.5 V

3.4 Brushless motor with encoder + Hall sensors



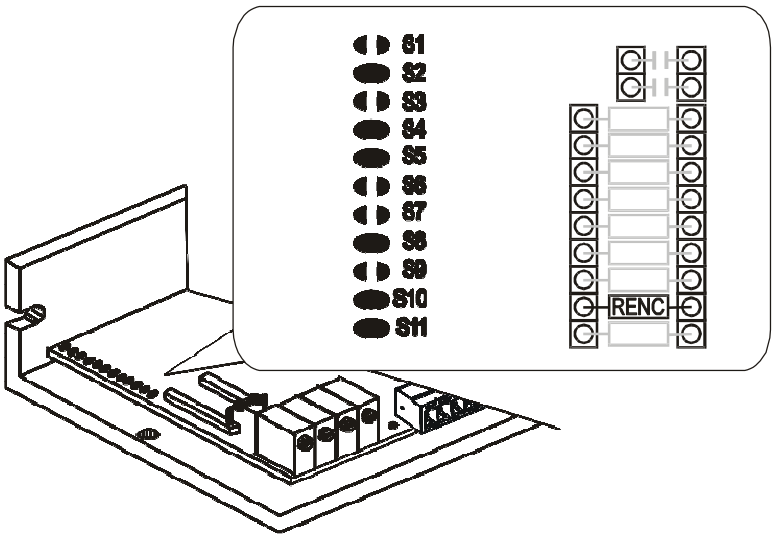
In the figure above is shown a typical connection.
The encoder with line driver output is connected directly to the control. Depart from the control wires A +, B +, GND to the converter (signals in common mode).
In the example the encoder is supplied by the CNC, while the hall sensors are supplied by Drive (+V terminal 12).
It's also possible to supply the encoder with the voltage present on the +5V of the drive (+V terminal 12), verifying that the absorption of the encoder does not exceed 100mA.
The converter is ble to provide 130mA max (100mA for encoder and 30mA for Hall sensors)

Hall sensors must be supplied using the internal +5V of the Drive (M1 connector 12). If an external supply is used, open solder bridge S11

Setting for Brushless motor with encoder

BLD10 in this configuration must have following set up:

SOLDER BRIDGES ADJUSTMENT ZONE



Solder Bridges set for:
- Brushless motor
- Encoder feedback
- Ramp time disabled
- Standard Dynamic constant

For the correct value of RENC resistor (speed adjustment range) see chapter 3.1

Note: On the adjustement zone are not considered here the other components used to determine other calibrations, for example: Calibration current rating etc

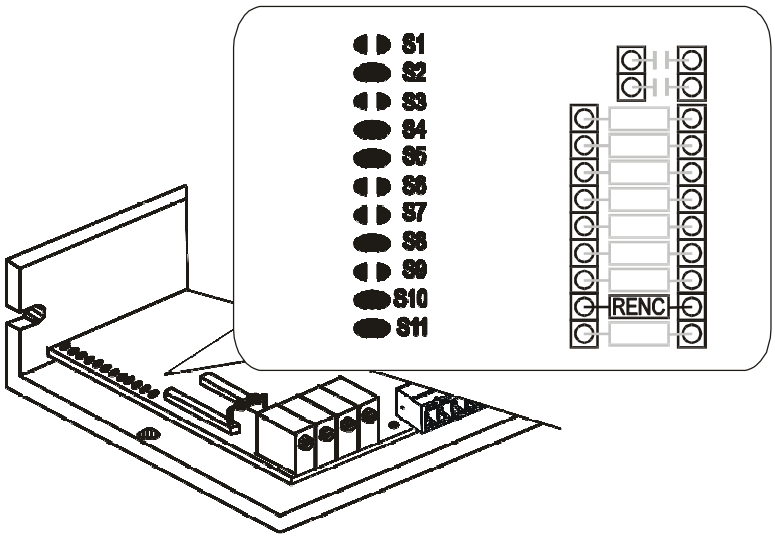
The resistance RENC inserted determines the full scale of the motor speed. To have a fine calibration, turn the trimmer SPEED located on the front. Moving the trimmer clockwise increases the speed, and viceversa counterclockwise. This calibration is to be performed with the motor running.

3.5 Set up for encoder feedback

This speed feedback allows the adjustment of the motor speed, using the signal from an incremental encoder two channels A and B. The signals from the encoder are read in a common way. The logical value of these inputs must be in the range of> + 2.8 / + 24V (minimum and maximum)

To get good dynamic performance on the motor, we recommend the use of encoders with at least 2000 / 2048PPR. Acceptable performance is obtained, however, even with the use of the encoder 500 / 512PPR. The settings and calibrations already shown in their respective sections enable the reaction encoder.

Even if the encoder is mounted, Hall signals are always necessary to be connected.



RENC resistor calculations

The drive is set with solder bridge S8 closed and the resistance calibration speed RENC mounted on board "27Kohm" (Calibration for speed = 3000rpm encoder with 10V reference and 500PPR line-count resolution encoder.)
In order to change this resistance, open the drive and calculate the following formula:

RENC = 681*1000000 /Fenc

The resistor RENC determine what is the max. speed of the motor at 10V of reference.

Where: **Fenc = PPR * RPM / 60**

Example: N° encoder pulses = 1000 PPR
Motor speed = 3000 RPM
RENC = 681*1000000 / 50000 = 13,62 kohm

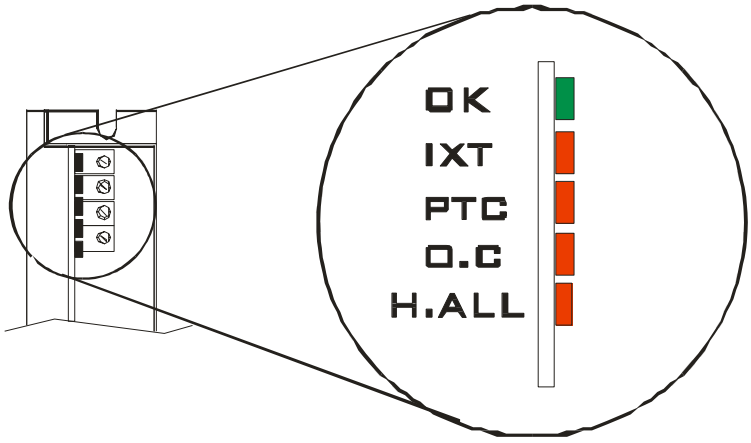
The result of **RENC** resistance is 13 K. Preferred resistance with 1% tolerance.

Once the resistor RENC is inserted, proceed with final speed adjustment.

Operate using trimmer **SPEED** on the front of the drive. With Clockwise Rotation the speed increases. With Counter Clockwise Rotation the speed decreases. The Range of regulation is about +/- 20%.

4.1 Indicator LEDs and protections

The protections are all displayed by five LEDs on the front of the drive. It also comes with a series of protections designed to safeguard the drive and the motor in case of malfunction.



FEATURES	
OK GREEN	**Normally ON.** Indicating the proper operation of all functions. It turns OFF in case of any anomaly "except protection intervention IxT". The faults that affect this LED are: Over/Under input voltage. Over temperature (PTC).
IxT RED	**Normally OFF.** This indicator is lit if the converter exceeding the limit calibration of the rated current of the motor. When the current drawn back under the nominal pre-set, the alarm will auto resets and the LED turns off by itself.
PTC RED	**Normally OFF.** This indicator is lit when the internal temperature of the drive reaches 75°C . Remove power and wait for the drive to cool before re-applying power. The operation causes the blocking of the drive and the storage of the alarm. NOTE: A fan, heat sink or air conditioner may be needed to remedy the problem.
O.C RED	**Normally OFF.** Indicates that between the motor terminals and/or ground, has been a short circuit. The operation causes the blocking of the drive and the storage of the alarm. Remove power supply and examine the motor connecting leads for shorts, before re-powering the converter to reset the alarm.
H.ALL RED	**Normally OFF.** If lit, it indicates that the Hall signal is missing, or the power supply +5V is missing. Check the Hall signals with a voltmeter or an oscilloscope.

In chapter 4.2, it explains the possible reasons for the alarms of the converter.

4.2 Troubleshooting

Possible causes for the alarms

- When power supply is on the green OK LED doesn't come on. Check the voltage between +HV and -GND with a tester.

- During deceleration of the motor, the LED green blinks. Increase the capacity filter. (example from 10.000uF to 20.000uF)

- LED lights red O.C. Check the connections U, V, W a short circuit can be between two of these wires, between one of these wires and ground, or short circuit inside the motor or the motor cables.

- LED lights red ixt. Excessive mechanical load

- LED lights red PTC. Ambient temperature too high, or the converter does not have a minimum circulation of air cooling, ventilation or missing where expected from the size of the converter.

- At Startup or Enabling the H.ALL Led comes on. One or more missing Hall Signals. Missing power supply to Hall Cells.

- With the green LED the motor will not start when you enable the drive with START
Check for the enable signal START. Also verify the presence of the speed signal between the terminals + /-VEL

- Motor goes out of control when enabled.
- Encoder signals incorrectly connected (ENC A and ENC B signals swapped, or encoder power supply missing, or signals swapped)

APPENDIX A

RESISTANCE VALUES DECODING BY THE MEANS OF COLOR'S RINGS

The resistances taken for calibration are "4 rings type" as photos.

For the decoding of the ohmic value, use the following table.
First ring = tens digit
Second ring = unit digit
Third ring = multiplier
Fourth ring = tolerance

COLOR	1° RING	2° RING	3° RING	4° RING
Black	-	0	x 1	-
Brown	1	1	x 10	-
Red	2	2	x 100	-
Orange	3	3	x 1.000	-
Yellow	4	4	x 10.000	-
Green	5	5	x 100.000	-
Blu	6	6	x 1.000.000	-
Violet	7	7	x 10.000.000	-
Grey	8	8	-	-
White	9	9	-	-
GOLD	-	-	: 10	5%
SILVER	-	-	: 100	10%
NOTHING	-	-	-	25%

For example, the resistance in the picture:
Brown = 1 (tens digit)
Black = 0 units digit
Red = Multiplier x 100
Gold = 5% tolerance
10 x 100 = 1K, 5% tolerance